The SPoRT-WRF: Evaluating the Impact of NASA Datasets on Convective Forecasts

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The Short-term Prediction Research and Transition Center (SPoRT) is a collaborative partnership between NASA and operational forecasting entities, including a number of National Weather Service offices. SPoRT transitions real-time NASA products and capabilities to its partners to address specific operational forecast challenges. One challenge that forecasters face is applying convection-allowing numerical models to predict mesoscale convective weather. In order to address this specific forecast challenge, SPoRT produces real-time mesoscale model forecasts using the Weather Research and Forecasting (WRF) model that includes unique NASA products and capabilities. Currently, the SPoRT configuration of the WRF model (SPoRT-WRF) incorporates the 4-km Land Information System (LIS) land surface data, 1-km SPoRT sea surface temperature analysis and 1-km Moderate resolution Imaging Spectroradiometer (MODIS) greenness vegetation fraction (GVF) analysis, and retrieved thermodynamic profiles from the Atmospheric Infrared Sounder (AIRS). The LIS, SST, and GVF data are all integrated into the SPoRT-WRF through adjustments to the initial and boundary conditions, and the AIRS data are assimilated into a 9-hour SPoRT WRF forecast each day at 0900 UTC. This study dissects the overall impact of the NASA datasets and the individual surface and atmospheric component datasets on daily mesoscale forecasts.

A case study covering the super tornado outbreak across the Central and Southeastern United States during 25-27 April 2011 is examined. Three different forecasts are analyzed including the SPoRT-WRF (NASA surface and atmospheric data), the SPoRT WRF without AIRS (NASA surface data only), and the operational National Severe Storms Laboratory (NSSL) WRF (control with no NASA data). The forecasts are compared qualitatively by examining simulated versus observed radar reflectivity. Differences between the simulated reflectivity are further investigated using convective parameters along with model soundings to determine the impacts of the various NASA datasets. Additionally, quantitative evaluation of select meteorological parameters is performed using the Meteorological Evaluation Tools model verification package to compare forecasts to in situ surface and upper air observations.

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